

NATIONAL SCIENCE FOUNDATION
Review (PI Copy)

Proposal:1637685

PI Name: Lovett, Gary

Title: LTER: Long Term Ecological Research at the Hubbard Brook Experimental Forest

Institution: Institute of Ecosystem Studies

NSF Program: LONG TERM ECOLOGICAL RESEARCH

Principal Investigator: Lovett, Gary M.

Rating: Very Good

Review:

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to intellectual merit.

HBR has been a leader in ecosystem ecology for so long now that it is the yardstick by which we compare other long-term research especially research focused at the ecosystem level and the HBR LTER has been in my view one of the top LTER sites for a very long time. I really liked the focus on how phenology or more specifically the vernal window might impact entire ecosystem level processes. I agree that this dynamic has been poorly studied and poorly integrated into ecosystem level models. I thought this was a very strong and compelling section within the proposal. I also liked the proposed research on phenological synchrony and potential phenological mismatches.

While much of this proposal was outstanding, the section entitled Theme 3 Changing Biota was not and this was reflected by the fact that little of this research was making it into top-tier and more general ecology journals (e.g., Ecology, Ecology Letters, Journal of Ecology) but rather was being published in more narrowly focused forest biology journals (CJFR). Overall, the previous and newly proposed work was descriptive, failed to use experimental approaches, and was not driven by important theory.

Several things jumped out at me with regard to how plant and animal species were changing over time at HBR. First, the proposal concludes 'Moose re-invaded the HBR forest beginning in the 1980s after a long absence (Groffman et al. 2012), and their browsing affects soil nutrient cycling (Christenson et al. 2010, 2014), tree and shrub layer vegetation dynamics, and consequently bird and Lepidopteran populations.' That is pretty much the end of the moose story here (except for some basic monitoring) and yet the impact of this super browser could be shaping forest regeneration since it arrived in the 1980's. Moose exclosures set up in Massachusettes (some at Harvard Forest) show the enormous impact these browsers have particularly in gaps (hotspot of regeneration) and this occurs even when they are at very low abundance across the landscape. Yet, the possibility that moose combined with deer browsing might be shaping forest regeneration was never considered. This oversight is even more remarkable given how many papers have been published on the impact of browsing by whitetail deer across much of the eastern deciduous forest. While deer alone may not be having a huge impact at HBR, in combination with moose, these large vertebrates may be strongly shaping patterns of forest regeneration.

Beech is highly browse tolerant (and increasing at HBR) partly because its bark is photosynthetic and because much of the regeneration after beech bark disease is from root sprouts (if beech above the reach of browsers can provide carbon clonally to smaller beech root sprouts, this could be a real benefit). Does anyone at HBR know the percent of beech regeneration that is occurring via root

NATIONAL SCIENCE FOUNDATION
Review (PI Copy)

Proposal:1637685

PI Name: Lovett, Gary

sprouts? This is critical in terms of its tolerance to browsers but moreover, if much of it is clonal, then beech bark disease is likely to spread back through the forest as soon as larger individuals of beech become vulnerable once again to BBD complex. Oddly, the proposal concludes 'Even more pronounced is the proportional increase in beech in the young adult size class (10-30 cm), which represents the canopy of the future.' Not if BBD complex spreads back through a dense and widespread regenerating layer of beech. This regenerating layer is currently of a similar size class and most of these root sprouts originated from their former parents that earlier succumbed to beech bark disease. This could indeed create a very novel forest dynamic: adult beech death, dense production of new root sprouts, sprouts grow into larger size classes that begin to succumb to BBD again all at the same time, followed once again by a dense new production of root sprouts

Overall, the research proposed to evaluate changing patterns of forest regeneration consists little more than descriptive demography where the only new angle is to look at smaller size classes and measure seed rain. This is disappointing. Even more disappointing was the response of HBR to the arrival of the emerald ash borer. Unlike most places, HBR has the resources to experimentally evaluate (via systemic insecticides) the impact of an invasive insect on a common tree species (ash) in the context of a forest where so much is known already about its structure and function. Other have already looked at gap phase replacement of ash following invasion by the emerald ash borer (Hermes and McCullough. Ann. Rev. of Entomology 2014) and little proposed in this proposal is very novel. The PIs need to be more creative here. Frankly the quality of the vegetation research coming out of HBR over the last decade has not been all that novel. In addition, while the proposal fully acknowledged that the hemlock woolly adelgid was also going to arrive at the forest soon, little was proposed with regard to the studying the impact of this species. Essentially, three major exotic insects and pathogens have or soon will impact the forest and the conceptual framework (Fig. 17) for this still treats these enemies as if they were just another disturbance, perhaps true but I feel the current approach lacks a strong theoretical or conceptual foundation. In addition, the arrival of moose in the 1980's also means the forest regeneration is now occurring with a major browser present. Finally, could the 'mystery' regarding the low watershed export of N over the last two decades be linked to changes in the dominance of the regenerating layer of beech that now makes up more than 60% of the intermediate size classes of trees. Doesn't beech litter have very low rates of decomposition. I also am pretty sure that beech has high N use efficiency as well. This comment may be off the mark but there seemed to be few links between major changes in the vegetation and patterns of nutrient cycles. Overall, the quality of the forest generation work that occurs at the community level at HBR is pretty average, has failed to take advantage of simple experimental approaches (fences), and has lacked a strong conceptual foundation. Also, while I applaud the authors for scaling up their research to landscape levels (Valley-wide approach), the research proposed for animal species was not driven by theory (foraging theory, ecology of fear, etc.) but rather, like much of the forest regeneration work, highly descriptive in nature. Surely the PI's can come up with a more interesting question than something vague about the 'relative importance of biotic and abiotic factors'. This section seemed like an afterthought.

In the context of the five review elements, please evaluate the strengths and weaknesses of the proposal with respect to broader impacts.

NATIONAL SCIENCE FOUNDATION
Review (PI Copy)

Proposal:1637685

PI Name:Lovett , Gary

The section on Education and Outreach simply asserted how much HBR was doing rather than demonstrating it more empirically. What specific curricula have you developed and how many school systems, teachers, and classrooms use it? How many RETs have you trained or have come through your program. What has Forest Science Dialogues Program actually accomplished and how many roundtables have you conducted and what is the upshot of these discussions? Likewise, what has the SPE accomplished? Frankly this part of the proposal talks a good game but it is entirely unclear whether you are actually playing a good game (my guess is that you are). This entire section had a grand total of 2 citations. Why not cite the actual curricula that you developed and give credit to those who developed it? The REU program seems strong but how many of these REU students have co-authored papers from their research or given talks at regional or national meetings? You say REU program is highly successful but you provide us with no evidence for this assertion. Overall, this section asserted how wonderful your outreach program has been but with little evidence. I am inclined to believe it but that is really based on a bit faith.

Please evaluate the strengths and weaknesses of the proposal with respect to any additional solicitation-specific review criteria, if applicable

None

Summary Statement

A vert strong proposal with the only weakness being the studies and proposed research on vegetation change and other biota.